MINISTRY OF TRANSPORT

American Road Construction Plant

Report of the Plant Investigation Team which visited the United States of America in July, 1964

LONDON
HER MAJESTY'S STATIONERY OFFICE
1964

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INTRODUCTION

1. The Minister visited the United States of America, as well as Canada, for the period from 28th April to 17th May, 1964. During the time he was in the United States he was given details of a wide variety of new types of construction equipment which are either already being brought into use in their road programme or are at this stage being used experimentally. The Bureau of Public Roads advised the Minister that many of the items in use were already helping to keep construction costs to a minimum.

2. The Minister on his return to this country decided to send a team of engineers to the United States to examine more closely the latest types of machinery being used there, and, in consequence after making arrangements with the Bureau of Public Roads in Washington, a team of three Government officials left London on 15th July, 1964. They were accompanied by three representatives from:

(i) The Federation of Civil Engineering Contractors;

(ii) The Federation of Manufacturers of Construction Equipment;

(iii) The Contractors Plant Association.

3. The terms of reference of the team were:

To investigate whether new types of road-making machinery in the U.S.A., now being used on road construction and experimentally, are appropriate for use on roadworks in this country.

To consider whether these items of plant would make a substantial contribution to the need to keep construction costs to a minimum.

To consider any aspects of the problem of introducing expensive new machinery into the United Kingdom road programme.

ITINERARY AND OBSERVATIONS

4. The combined party visited the Bureau of Public Roads in Washington, and Interstate highway projects in Washington D.C., Virginia, Maryland, Illinois, Iowa, Seattle and Washington State, and California where they inspected or obtained information about items of plant not in common use in the United Kingdom. These can be divided up into four main groups:

(i) Formation preparation machines;

(ii) Sub-base (base) spreading machines;

(iii) Slip-form concrete paving machines; and

(iv) 24 ft. wide bituminous pavers.

Earthmoving and compaction machinery

5. After comparing notes with the Bureau of Public Roads it was quite clear to the team that the United Kingdom was abreast of the United States in the full use of the latest earthmoving and compaction machinery, many types of which are manufactured in the United Kingdom under licence from the United States.

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Central batch mixers

6. The party's attention was drawn to the recent United States trend towards the use of central batch mixers for concrete and a number of examples in operation were shown. The use of such plant has, of course, been normal practice in the United Kingdom for many years.

MACHINERY IN USE IN THE UNITED STATES WHICH IS NOT IN GENERAL USE IN THE UNITED KINGDOM

Formation preparation machines

7. The significant development in this field is the guide-wire controlled fine grading machine which is designed to cut and trim materials to an accurate profile (*see* Plate 1). The advantage of this machine is that it provides a true grade line and crossfall at the same time as producing a large output. The accuracy of levels achieved substantially reduces the amount of material required to ensure a minimum thickness of subsequent constrnction courses. The machine can also be used to trim the surface of granular materials in sub-bases and bases. The machine is rapidly increasing in popularity and the number in use appears to be limited only by the factory output of machines.

Sub-base (base) spreading machines

8. A group of machines is in course of development which spread and compact base materials from windrows of controlled size, the final surface levels being controlled from guide-wires (*see* Plate 2). Control systems vary but may be hydraulic, electronic/hydraulic or pneumatic. The machines are not yet giving complete satisfaction in use but the progress of development should be watched.

9. At the moment conventional spreading methods are used and final levels controlled by trimmers controlled by guide-wires, concreting forms or from the average gradients of the spread materials (*see* Plate 3(b)). One machine similar to those in course of development, but without automatic control, was observed giving acceptable results.

Slip-Form Concrete Paving Machines

10. The most modern development in concrete paving is the use of slip-form machines. The party saw the products of three manufacturers actually engaged in paving in the field. A fourth machine, which had been used in development trials, was in course of modification in the factory. An increasing number of State Highway Authorities are permitting the use of slip-form pavers and the indications are that these machines will eventually supplant the use of machines paving between steel forms as current machinery reaches the end of its useful life. In the United States the achievement of a satisfactory standard of riding quality of paving laid with slip-form pavers is dependent on close tolerances in level being achieved on the formation and on the surface of the base by the use of the machines referred to in paragraphs 7 to 9. One of the three machines in use (*see* Plates 4 & 5) was laying reinforced concrete similar to the M.O.T. specification, with dowelled contraction joints but without expansion joints.

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The party saw no serious problem in providing expansion joints with the machine. The machine as operated was not guide-wire controlled but the manufacturer assured the party that a system was available if a demand materialised. The manufacturer of one of the other slip-form pavers provided the party with drawings showing the way in which his machine could be adapted for laying reinforcement (*see* Plate 6). His machine has not laid reinforced concrete roads but he has a similar machine for lining canals and aqueducts which has been used for laying reinforced concrete paving. It is difficult to see how the third machine in use could be used for the laying of concrete to M.O.T. specification without the elimination of reinforcement (*see* Plate 8(a)).

Reinforcement embedding machine for concrete pavements (*see* Plate 7)

11. An important development in the construction of concrete paving between side forms is a machine for the embedding of reinforcement through the surface of concrete already placed. The machine eliminates the necessity for the use of a second spreading machine for placing the layer of concrete above a reinforcing mat.

Bituminous Pavers (*see* Plate 8(b))

12. The latest development is a machine which lays, from windrows, a 24 ft. width of bituminous paving. Only one machine is currently in existence and is in course of development. Some difficulties in operation are still being experienced. It is claimed that the machine will also handle cement treated base materials. Apart from this machine all the types of bituminous paving machinery in use in the United States have already been introduced into the United Kingdom.

13. It is noticeable that the speed of operation of all paving machines, for concrete, bituminous and cement bound materials, is limited by the maximum output of mixing plants and by the means of delivery to the laying site.

CONCLUSIONS OF THE GOVERNMENT TEAM

14. The wire controlled machines for the trimming of lower layers of construction and the manually controlled machines for the spreading of base materials are appropriate for use in the United Kingdom.

15. Slip-form pavers which can incorporate reinforcing mesh and machines for embedding or reinforcing mesh in concrete paving between side forms are also appropriate.

16. On completion of development the wire controlled base laying machines will be appropriate for use in the United Kingdom.

17. The 24 ft. wide bituminous paver would appear to be appropriate for use in the United Kingdom on satisfactory completion of development.

18. The rapid increase of usage of the new machines in the United States indicates that there is an economic advantage in their use in conditions where

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the high United States labour costs prevail. The machines can produce a saving in man hours per unit of work which will show increased cost benefits in the United Kingdom as wage rates rise. The full benefits, however, are contingent on the use of United States methods of construction and principles of design and contract control.

19. Of the new types of machine observed, it appeared that none represented a financial commitment larger than that undertaken by British Contractors engaged on current major works. In the case of the slip-form pavers, however, a modification to the British Specification will be necessary to permit of their use and industry would need to feel assured of continuity of use in the Road Programme before it could be expected to invest in slip-form pavers.

20. One of the lessons learned from the tour has been that considerable benefits to the progress of highway engineering in the United Kingdom can result from the bringing together of representatives from Government Service and from industry. It is recommended that means be sought to ensure that such co-operation can be maintained on a continuous basis to keep under review modern developments of plant and technology, and ensure that our specifications are abreast of current trends.

Acknowledgements

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The Civil Engineering Contractors and Plant Manufacturers whose sites and factories they visited.

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1 (a) Virginia—Interstate Highway 81
Winchester

'Rex-Gurries' wire controlled fine grader trimming formation.

1 (b) Iowa—Interstate Highway 80
Victor

'Rex-Gurries' fine grader trimming base with guide-wire control.

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2 (a) 'Ko-Cal' Base Spreader and Compactor
Demonstration of spreading from windrows.
Note guide-wire in foreground.

2 (b) 'Ko-Cal' Base Spreader and Compactor
Rear view showing compacted base ready for final rolling.

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3 (a) Washington State—Interstate Highway 5
Seattle

'Rex-Gurries' road planer trimming compacted base.

3 (b) California—Interstate Highway 80
Donner Pass

'Lewis' base spreader handling granular material from two windrows.

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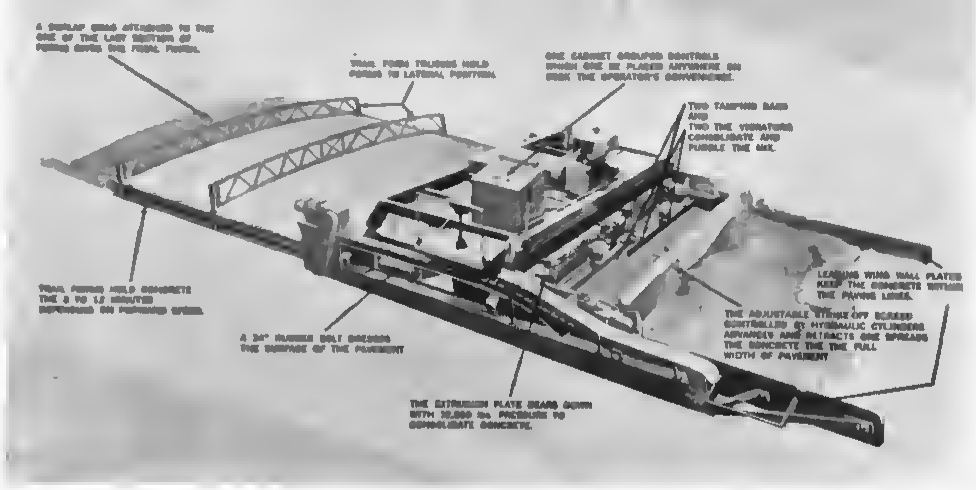

4 (a)

4 (b)

4 (c)

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Opposite page:

4 (a) A diagrammatic illustration of Slip-Form Paver

Note strike-off screed spreading concrete in advance of machine, and trusses controlling trailing slip-forms.

4 (b) Iowa—Interstate Highway 80
Victor

Finished base showing contraction joint cages and reinforcing mesh laid out ahead of slip-form paver.

4 (c) Iowa—Interstate Highway 80
Victor

Placing bottom layer of concrete pavement and reinforcing mesh ahead of slip-form paver. Note travelling paver mixer in background, supplied with dry-batched materials.

5 (a) Iowa—Interstate Highway 80
Victor

'Rex' slip-form paver placing top layer of concrete, compacting full 10 ins. depth and finishing. Note use of scraping straightedges and burlap drag.

5 (b) Iowa—Interstate Highway 80
Victor

Finished concrete pavement behind 'Rex' slip-form paver before application of curing compound.

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6 (a) California—Interstate Highway 80 Donner Pass

Delivering concrete to spreader unit of 'Guntert & Zimmerman' slip-form paver.

Opposite page:

7 (a) Illinois—Interstate Highway 57

Placing reinforcement mesh from carrier in front of 'Parro' mesh-embedding machine on concrete laid to full depth.

7 (b) Illinois—Interstate Highway 57

'Parro' mesh-embedding machine about to vibrate reinforcement into position.

7 (c) Illinois—Interstate Highway 57

Finishing pavement surface with scraping straightedge behind 'Parro' concreting train.

6 (b) Concrete paving slab placed by Guntert & Zimmerman slip-form paver.

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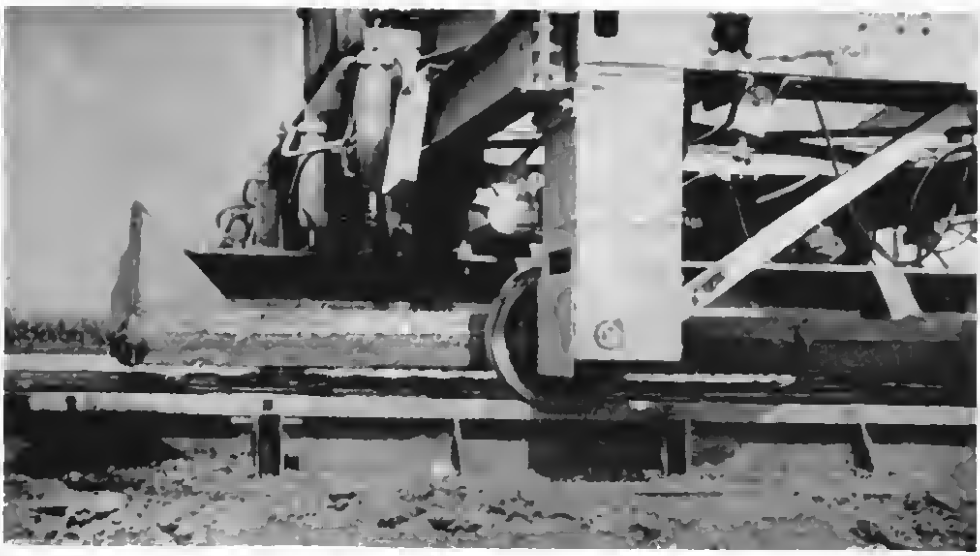
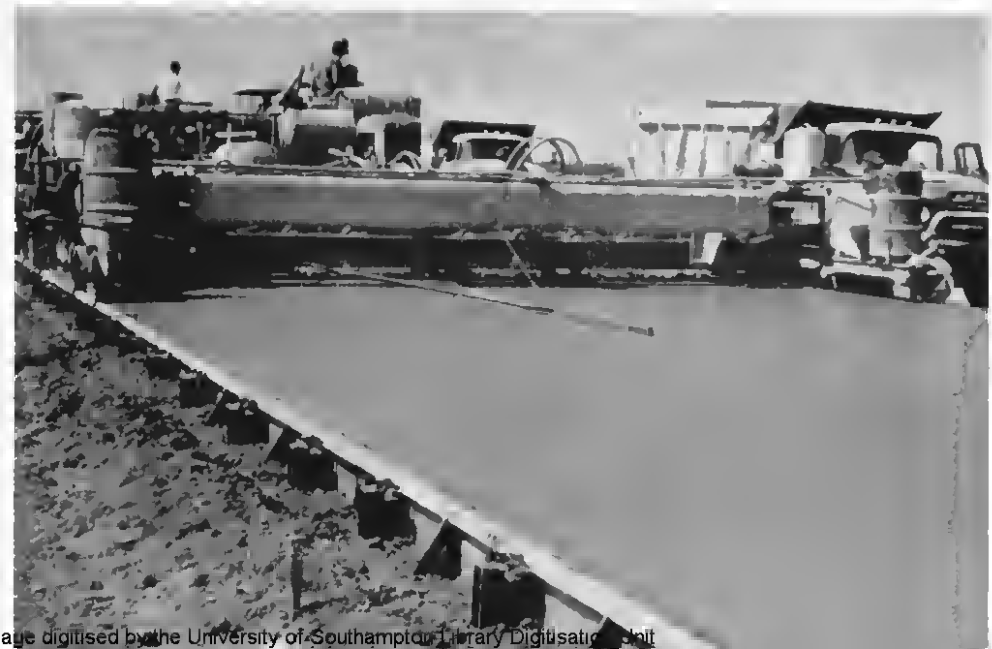
7 (a)



7 (b)

7 (c)



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8 (a) California—Interstate Highway 80
Donner Pass

Finishing machine in 'Lewis' slip-form paving train.

8 (b) Iowa—Interstate Highway 80
Iowa City

'Honeywell—Minneapolis' control fitted to 'Barber-Greene' bituminous paver with travelling string-line.

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